late Prof. Fr. Diez was of different opinion. He thought that Italian was that Romance language which formed the nearest approach to Old Latin. But there is no doubt that Spanish and Portuguese show considerable repugnance against the sound *f*, and that the double pronunciation of *r* in Spanish and Portuguese is identical with the one we find in Basque. Gerland also proposes the query, whether the softened *l*, *ñ*, *n*, so frequent in Basque, have caused the softening of *l* and *n* into *ll* and *ñ* of Spanish as well as of Portuguese, or whether this must be ascribed to other causes.

THE GREAT MARCH BLIZZARD.

THE great storm off the Atlantic coast of the United States of March 11–14 will probably go into history as the most severe experienced since this country has been inhabited by Europeans. Not only was it remarkable for its force and duration, but also for the unexpected manner of its appearance and development, and for the track it followed from the time it was first observed to that of its final disappearance.

No previous great storm at sea has been as thoroughly studied from such abundance of data as this very fortunately has been. From the time that the first vessel arrived in port which had encountered the storm at sea, to the present, the Hydrographic Office of the Navy Department has been collecting, arranging, and comparing all the reports in regard to it that have been received, and will soon publish a monograph giving a history of the great disturbance, illustrated by a number of carefully prepared maps and charts. Mr. Everett Hayden, who has had charge of the work, in a paper recently read before the National Geographic Society, gave the substance of what this monograph will contain. The following is an abstract of his paper.

Mr. Hayden began by referring briefly to the difficulties and delays that necessarily attend the collection of data by which to study the character and progress of a great ocean-storm, and illustrated these by stating the fact that a ship which recently arrived at New York from Calcutta supplied very valuable facts regarding one of the great hurricanes of August last, from a region to the westward of the Cape Verde Islands, where data were especially needed.

Four large colored charts were used to illustrate the meteorological conditions over the area charted (latitude 25° to 5° north, longitude 50° to 85° west) at 7 A.M., 75th meridian time, March 11, 12, 13, and 14 respectively. These charts contained isobars for each tenth of an inch, reduced pressure, and isotherms for each 10° F.; temperatures above freezing, in a tint of varying intensity of red; and below freezing, of blue. A large track-chart with vessels' positions and tracks enabled the audience more clearly to follow the discussion and the storm-reports which were quoted. A barometer diagram illustrated the fluctuations of the barometer at six land-stations and on board six vessels, selected with special reference to the completeness of their data, and their position relative to the storm. Diagrams were prepared, also, to show the varying height of the barometer along north-and-south sections, selected to emphasize the fact that the special feature of the storm was its trough-like form, the isobars about the area of low barometer being elliptical in shape, along a north-and-south line, and moving eastward between two ridges of high barometer.

The synchronous weather-charts were discussed successively. The first, that for 7 A.M., March 11, showed a trough of low barometer reaching from the Gulf far northward, past the eastern shore of Lake Huron, toward the southern limits of Hudson Bay. Off the coast a ridge of high barometer stretched down from the Gulf of St. Lawrence toward Santo Domingo, passing about midway between the Bermudas and Cape Hatteras. To the westward another ridge of high barometer extended from Dakota to below the Rio Grande. Along the coast the prevailing winds were therefore easterly and south-westerly; the warm, moist air drawn up from down within the tropics causing a warm wave, with generally cloudy weather and rain. In rear of the line of low barometer, a cold, north-westerly wind was blowing, carrying a cold wave far down into the Gulf, with frosts as far south as Louisiana and Mississippi, and cool northerly winds clear down to Vera Cruz.

Before considering the next chart, a description was given of the meteorological conditions off the coast, awaiting the advance of this long line of cold north-westerly gales, which was moving eastward at the rate of about six hundred miles a day. Attention was also called to the importance of considering, in this connection, the vitally important influence of the great warm ocean-current, the Gulf Stream, in increasing the energy of storms when they reach the coast. By way of more vividly illustrating the energy of action developed when cold winds blow over it, mention was made of the many water-spouts reported off the coast the last few months, and a few of those reports were quoted. It was shown, also, that the surface temperature in the axis of the Gulf Stream off Hatteras was as high as 76°, while that of the cold inshore current was fully 30° lower.

The storm was then followed as it approached the coast, its energy increasing every hour, and the barometric depression deepening. At 3 P.M., one centre, with pressure as low as 29.7, had just passed the coast south of Hatteras; while another, with pressure quite as low, or lower, was central over the Province of Ontario. Although the general trough-like form of the storm remained, as clearly indicated by reports from vessels all along the coast, yet another secondary storm-centre, and one of very great energy, formed offshore, north of Hatteras, as soon as the line had passed the coast. It was this centre, in violence fully equal to a tropical hurricane, and rendered still more dangerous by the freezing weather and blinding snow, which raged with such fury off Sandy Hook and Block Island for two days, — days likely to be long memorable along the coast. Its long continuance was probably due to the retardation of the centre of the line in its eastward motion, by the areas of high barometer about Newfoundland; so that this storm-centre delayed between Block Island and Nantucket, while the northern and southern flanks of the line swung around to the eastward, the advance of the lower one gradually cutting off the supply of warm, moist air rushing up from lower latitudes into contact with the cold north-westerly gale sweeping down from off the coast between Hatteras and Nantucket.

So far as the ocean is concerned, the night of the 11th–12th saw the great storm at its maximum, and its great extent and terrific violence make it to be one of the most severe ever experienced off our coast. Only a few corrected barometric readings were lower than 29, and the lowest pressure was probably not lower than 28.9, although lower readings were observed a few days later off the Grand Banks.

The chart for 7 A.M., March 12, showed the line or trough with isobars closely crowded together southward of Block Island, but still of a general elliptical shape, the lower portion of the line swinging eastward toward Bermuda, and carrying with it violent squalls of snow and hail far below the 35th parallel. The high land of Cuba and Santo Domingo prevented its effects from reaching the Caribbean Sea, although it was distinctly noticed by a vessel south of Cape Maysi, in the Windward Channel. The isotherm of 33° reached from central Georgia to the coast below Norfolk, and thence out into the Atlantic to a point about one hundred miles south of Block Island. Farther north, it ran inshore of Cape Cod, explaining the fact that so little snow, comparatively, fell in Rhode Island and south-eastern Massachusetts.

By next morning the storm was beginning to decrease in severity; and the chart shows that westerly winds and low temperatures had spread over a wide tract of ocean below the 40th parallel, while over the ocean north of that parallel the prevailing winds were easterly. The lower storm-centre was now in about latitude 40° north, longitude 39° west, with a pressure of 29.30; and the other a little distance south of a line from Nantucket to Block Island, barometer 29, the isobars extending in a general easterly and westerly direction. The delay of the storm off the coast, and its rapid increase of energy, had been shown in the most marked manner by the fluctuations of the barometer at land-stations and aboard vessels, and the barometer diagram was referred to by way of illustration.

March 14 the storm off Block Island had almost died away, with light variable winds and occasional snow-squalls; the other centre was about two hundred miles south-east from Sable Island. The great wave of low barometer had overspread the entire western portion of the North Atlantic, with unsettled, squally weather from Labrador to the Windward Islands. The area of high pressure in

advance had moved eastward, to be felt over the British Isles from the 17th to the 21st of the month, and after it a rapid fall of the barometer. The isotherm of 32° reached from the southern coast of North Carolina well offshore, thence northward to the coast of Maine, and from central Maine eastward across Cape Breton Island and southern Newfoundland. From the south-eastern to the north-western portion of the chart, the shades of color showed a difference of temperature of more than 80° (from above 70° to below—10°); but such great differences of temperature and pressure could not last long, and the normal conditions were gradually restored.

ELECTRICAL SCIENCE.

Atmospheric Electricity.

THE *London Electrician* contains an abstract of a paper by Prof. L. Weber which is of interest. He erected two insulated conductors on the top of the Riesengebirge; but he says, that, curiously enough, since they have been put up, they have never been struck by lightning, although before their erection lightning-flashes were continually occurring. He also made some kite and balloon experiments, in connection with which he goes at considerable length into the question of the effect of the conducting-string in altering the electrical condition of the circumjacent air layers, and also considers the effects due to a long conductor completely insulated from the earth, and without discharging-points; a similar conductor, with slight power of discharge along its whole length; an insulated conductor, with strong discharge-power (e.g., a flame) at the upper end; and other similar and more complicated cases. His kite-string was really a steel wire. The discharge-points of the kite consisted of 400 needle-points. In other cases he had the tails of the kite made of silver paper for the same purpose. The potential was measured by the length of sparks; the current, with a galvanometer. The latter varied in general from .07 to 2.5 micro-ampères. The potential varied generally from 3,000 to 10,000 volts. When thick clouds were overhead, there were no appreciable sparks, the strongest sparks being obtained when the zenith was either quite clear, or when cumulo-stratus clouds appeared. With potentials of 11,000 and 20,000 volts, currents of 4 and 8 micro-ampères were obtained.

INCANDESCENT LAMPS WITH ALTERNATING AND DIRECT CURRENTS. — Professors Ayrton and Perry have carried on a series of experiments to determine whether the efficiency of incandescent electric lamps is the same when supplied with alternating currents and with direct currents. The following table gives the results of measurements on four different lamps: —

Lamp.	No. of Experiments made.	Watts per Candle. *White Light.*			
		Continuous.		Alternating.	
1	20	3.053		3.033	
		Green Light.		*Red Light.*	
		Continuous.	Alt.	Continuous.	Alt.
2	19	2.597	2.534	3.100	3.100
3	20	2.935	2.966	3.254	3.164
4	16	2.900	3.073	3.504	3.477
Mean of last three experiments..		2.811	2.857	3.286	3.247
		Continuous.		Alternating.	
Mean of all results............		3.049		3.0497	

These results show, that, as far as the economy of the lamp is concerned, the efficiency of the two systems is about the same. What the life of the lamp would be with alternating currents is a matter which has yet to be decided. Considering the rapidity with which small wires respond in temperature to changes in current, it might be, when the period of the alternating current is not extremely rapid, that the filament of a lamp supplied by such a current would be at times at a much higher temperature than the average, at other times at a lower temperature. If this were the case, we would expect that the life of a lamp supplied in this way would be less than that of the same lamp fed by a continuous current. With 300 reversals a second, however, the temperature would vary but little, and there is no reason that the life of the lamp should not be the same with continuous and alternating currents.

POLARIZATION OF PLATINUM PLATES. — Mr. C. H. Draper has experimented on the electro-motive force of polarization between platinum plates immersed in dilute sulphuric acid, for different strengths of current passing between the plates, and with different temperatures. It is well known, that, if an electric current be sent between such plates, an electro-motive force of polarization is produced, in a direction opposite to that of the impressed electro-motive force, and of a value something in the neighborhood of one and a half volts. Mr. Draper tried to find if this opposing electro-motive force was independent of the current and temperature, and, if not, in what way it varies with them. The conclusions at which he arrives are as follows: 1. The opposing electro-motive force of polarization which arises in cells when at work depends on the value of the current passing through them when that current is below a certain value, increasing, but more and more slowly, with the current; 2. There is a maximum value of the polarization regarded only as a function of the current strength, beyond which any increase in the strength of the current has no effect upon it; 3. The electro-motive force of polarization varies with temperature, its value decreasing about one per cent for a rise of temperature of 40°.

ELECTRIC MINING ROAD AT LYKENS. — Among the interesting applications of electricity to mining-work, the electric road in the coal-mines at Lykens, Penn., is one of the most successful. It has been pointed out in this journal that electricity offers especial advantages for use at mines where fuel is scarce and water-power of easy access, as in the silver and other mines in our Western territory; but, besides the decreased cost of fuel, the ease with which electric motors can be used in almost any position, under conditions that steam-engines could not meet, makes electric transmission still more valuable. In coal-mines the cost of fuel is, of course, a small item; but the greater safety, efficiency, and flexibility of a system of electrical distribution, as compared with a number of steam-engines, give it an advantage which must soon be recognized. In the Lykens Valley Mines there has been used for some time an electric-motor car to take the place of mules for hauling cars from the mine. The length of the road is 6,300 feet; the weight of the locomotive, 15,000 pounds; the largest load it is capable of handling, 150 tons; the speed, 6 to 8 miles per hour. A second road on the same general plan is being equipped for the same company. The system employed is the Schlesinger.

DESIGNING DYNAMO-ELECTRIC MACHINES. — Until very recently the designing of dynamo-electric machinery was an empirical matter. The practice was to roughly guess, from the dimensions of some similar machine, about what the dimensions should be to give the required output, and, after the dynamo was built, to change the number of revolutions or the winding of the field-magnets until the required conditions were fulfilled. Sometimes even this would not suffice to bring the machine to its output, in which case another was built. In the last two years the papers of Mr. Kapp and Dr. Hopkinson, together with the growing habit of treating a magnetic circuit in the same way that ordinary electric circuits are treated, introducing the idea of magnetic resistance, have greatly increased the certainty with which dynamos may be designed. In fact, from experiments on one machine of a type, we can design another of the same type to give any required output, with considerable accuracy. While this is not generally recognized in this country, it soon will be, and a great deal of expense and energy will be saved; besides which, a consideration of the magnetic resistance of various parts of the magnetic circuit of a dynamo